

<https://helda.helsinki.fi>

---

## Working conditions and antidepressant medication use : A prospective study among 18 to 39-year-old municipal employees

Lahti, Jouni

2021-11

---

Lahti , J , Lallukka , T , Harkko , J , Nordquist , H , Mänty , M , Pietiläinen , O , Rahkonen , O & Kouvonen , A 2021 , ' Working conditions and antidepressant medication use : A prospective study among 18 to 39-year-old municipal employees ' , Psychiatry Research , vol. 305 , 114213 . <https://doi.org/10.1016/j.psychres.2021.114213>

---

<http://hdl.handle.net/10138/335085>

<https://doi.org/10.1016/j.psychres.2021.114213>

---

cc\_by

publishedVersion

---

*Downloaded from Helda, University of Helsinki institutional repository.*

*This is an electronic reprint of the original article.*

*This reprint may differ from the original in pagination and typographic detail.*

*Please cite the original version.*



# Working conditions and antidepressant medication use: A prospective study among 18 to 39-year-old municipal employees

Jouni Lahti<sup>a,\*</sup>, Tea Lallukka<sup>b</sup>, Jaakko Harkko<sup>a</sup>, Hilla Nordquist<sup>a,b,c</sup>, Minna Mänty<sup>b,d</sup>, Olli Pietiläinen<sup>b</sup>, Ossi Rahkonen<sup>b</sup>, Anne Kouvonen<sup>a,e</sup>

<sup>a</sup> Faculty of Social Sciences, University of Helsinki, Helsinki, Finland

<sup>b</sup> Department of Public Health, University of Helsinki, Helsinki, Finland

<sup>c</sup> South-Eastern Finland University of Applied Sciences, Helsinki, Finland

<sup>d</sup> City of Vantaa, Vantaa, Finland

<sup>e</sup> Administrative Data Research Centre (Northern Ireland), Queen's University Belfast, Belfast, United Kingdom

## ARTICLE INFO

### Keywords:

Work demands  
Young employees  
Young adults  
Mental health  
Depression

## ABSTRACT

This study aimed to examine the associations of perceived physical and mental working conditions with subsequent antidepressant medication purchases among 18-39-year-old municipal employees. Survey data collected in 2017 among employees of the City of Helsinki ( $n=5897$ , response rate 51.5%) were linked to register data on psychotropic medication purchases (82% gave permission to register linkage). The analysis included 3570 women and 972 men. We used three single-item measures of working conditions: perceived mental and physical strenuousness of work, and time spent in physical work. Covariates included age, gender, marital status, employment status, body mass index, smoking, alcohol use and previous medication. Cox regression analysis was used to calculate hazard ratios (HR) for the first antidepressant medication (ATC class N06A) purchase during a one-year follow-up. Those with mentally strenuous work (HR 1.85) as well as those spending more than four hours in physical work per workday (HR 1.60) had an statistically significantly increased risk of antidepressant medication use when adjusting for age and gender. Further adjustments for covariates attenuated these associations, which however remained statistically significant. Improving working conditions to avoid excess mental and physical workload is likely to be beneficial for preventing mental health problems already among younger employees.

## 1. Introduction

Mental health problems are a major work-life as well as public health concern (Whiteford et al. 2013). Especially young adults are likely to experience mental disorders such as depression (Jones 2013). Depression is the single largest contributor to non-fatal health loss worldwide (GBD 2020), and causes a huge burden on society as well as affects the quality of life of individuals suffering from depression (Whiteford et al. 2013). Antidepressant medication is a typical treatment for depressive symptoms (Lewer et al. 2015). Antidepressant medication use has increased dramatically during the 21<sup>st</sup> century and is now very common in Western countries including Finland (Lewer et al. 2015).

A considerable number of studies have been published on working conditions and mental health and psychotropic medication use during past few decades including several reviews and meta-analyses

summarising the findings (Woo et al. 2008, Bonde 2008, Theorell 2015). Several work stress models (Karasek 1998, Siegrist 1996) as well as other work-related factors (Henderson et al., 2011) have been utilised to examine the relationships between working conditions, mental health and psychotropic medication use. A review by Theorell et al. (2015) concentrating on depressive symptoms showed that working conditions are associated with depressive symptoms in varying magnitude. The strongest evidence was found for high mental work strain (high demands and low control) increasing the risk of depressive symptoms. Most previous studies have focused on psychosocial working conditions, and the association is well established for various measures of mental health (Woo et al. 2008, Bonde 2008, Theorell 2015) including psychotropic medication (Laaksonen et al. 2012, Kouvonen et al. 2017). Only few studies have examined the associations between physical working conditions and subsequent psychotropic medication use (Laaksonen et al.

\* Corresponding author.

E-mail address: [jouni.mm.lahti@helsinki.fi](mailto:jouni.mm.lahti@helsinki.fi) (J. Lahti).

<https://doi.org/10.1016/j.psychres.2021.114213>

Received 31 March 2021; Received in revised form 13 September 2021; Accepted 17 September 2021

Available online 20 September 2021

0165-1781/© 2021 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

2012, Kouvonen et al. 2017).

Despite all the studies conducted during the past decades on working conditions and mental health, further studies are needed as work life is becoming even more mentally demanding (Harvey et al. 2017). For instance, digitalisation and a continuous need for learning and competition may cause excess mental strain (Taylor et al. 2017). In addition, physical work demands are still relevant in many occupations, including lower-grade occupations in the municipal sector. High physical workload may also associate with mental health already among young employees (Lallukka et al. 2020b). However, physical demanding work in relation to mental health outcomes has been less examined in prospective settings (Theorell et al. 2015). Moreover, there are methodological shortcomings in previous studies as many have used self-reports on both mental health and working conditions, which may lead to biased results i.e. the same source bias. Although the number of prospective studies is increasing, the majority of previous studies have applied cross-sectional study designs, which limits causal inference. To avoid these methodological shortcomings, we used prospective register-based measure of mental health and aimed to examine the associations of perceived physical and mental strenuousness of work and time spent in physical work with subsequent antidepressant medication use among 18-39-year-old municipal employees.

## 2. Methods

### 2.1. Study population

Survey data were collected in autumn 2017 among all employees of the City of Helsinki who were born in 1978 or later (aged 18 to 39 yrs) with at least 50% employment contract and employment lasting for at least 4 months (probation period) (Lallukka et al. 2020a). The City of Helsinki is the largest employer in Finland with approximately 37,000 employees annually. The City provides basic services for its residents, such as education, health and social care and public administration. Thus, the employees represent wide range of occupational titles and the largest occupational groups include kindergarten staff, care workers, nurses, and teachers. Survey data were collected mainly via secure online server, and in addition, to those without email addresses or who did not respond online, postal questionnaires were mailed. Furthermore, for non-respondents to the online and postal surveys, data on selected range of variables were collected with telephone interviews. The final response rate was 51.5% and the number of participants was 5897 (4630 women and 1267 men) (Lallukka et al. 2020a). The gender distribution matches that of municipal employees in the target population, (Lallukka et al. 2020a) and the municipal sector in Finland in general. The non-response analysis showed that the data are broadly representative of the target population with respect to key variables, i.e., sociodemographic and work-related factors and health (Lallukka et al. 2020a). The survey data were prospectively linked to the national register on prescribed antidepressant medication purchases obtained from the Social Insurance Institution of Finland (82% gave informed written consent for the linkages (n=4864)). We excluded those not working due to health reasons (e.g. disability retirement or over six months sickness absence) at the time of the survey (n=24). There were some missing information in the study variables (n=298) and thus the final analytical sample included 3570 women and 972 men (n=4542). The ethical committee of the Faculty of Medicine, University of Helsinki gave their approval for the study protocol. Additionally, the City of Helsinki provided permission to conduct this study and Social Insurance Institution of Finland gave permission to linkages to their register.

### 2.2. Antidepressant medication

Data of the purchases of prescribed reimbursed psychotropic medication were derived from the registers of Social Insurance Institution of Finland. The Finnish Prescription Register includes records of all

prescribed psychotropic medication purchases reimbursed to permanent residents in Finland. For each medication, the record includes the WHO Anatomical Therapeutic Chemical (ATC) code, and the quantity as defined daily doses (DDD) and the date of purchase (WHO, 2009). We used antidepressant (N06A) purchases as the outcome (=antidepressant medication use) and DDDs were included for descriptive purposes. The follow-up started on the day of responding to the survey and continued for a one year for all participants in the analytical sample. There were no deaths during the follow-up (Statistics Finland Causes of Death Register) and the follow-up was complete for all participants.

### 2.3. Working conditions

For mental strenuousness of work, a single-item questions with four response alternatives ('very light', 'rather light', 'rather strenuous' and 'very strenuous') was included, asking how mentally strenuous the respondent considered her or his work. Mental strenuousness of work was classified into three groups: 1. mentally non-strenuous (very light/rather light), 2. intermediate (rather strenuous) and 3. mentally strenuous (very strenuous).

For physical strenuousness of work a single-item question similar to that for mental strenuousness was included and classified accordingly to three groups: 1. physically non-strenuous (very light), 2. intermediate (rather light) and 3. physically strenuous (rather strenuous/very strenuous). In addition, a single-item question asking how many hours per workday the respondent engaged in physical work such as heavy lifting and climbing stairs was included. Volume of physical work was classified into three groups: 1. no physical work, 2. intermediate (4 hours or less per day) and 3. high (more than 4 hours per day).

### 2.4. Covariates

We included gender (men/women) and age divided into three groups at baseline: 18-29, 30-34, 35-39 years. Marital status was dichotomised to cohabiting/married and others (unmarried, widowed, divorced). We included a dichotomised variable of employment status to distinguish respondents who were temporarily outside the labour market (e.g. studying, on parental leave or unemployed) from those working (full or part-time). Current smoking was dichotomised as smokers (daily and occasional) and non-smokers (never smokers and quitters). Alcohol use was dichotomised as those using alcohol weekly and occasional users (including non-drinkers). Body mass index was categorised as normal weight (<25kg/m<sup>2</sup>), overweight (25kg/m<sup>2</sup>-30kg/m<sup>2</sup>) and obese (>30kg/m<sup>2</sup>). Antidepressant medication use during a three-month period before survey participation date was dichotomised into those with previous medication use and those without.

### 2.5. Statistical methods

First, the numbers and proportions of those with antidepressant medication use during the one-year follow-up period by covariates and working conditions were calculated. For those with medication use, mean DDDs and their standard errors (s.e.) were calculated for descriptive purposes. Cox regression analysis was used to calculate hazard ratios (HR) and their 95% confidence intervals (95% CI) for first antidepressant medication purchase during the one-year follow-up period. Interaction tests were conducted to examine whether the associations between working conditions and subsequent antidepressant medication use differed between women and men. There were no significant interactions, for mental strenuousness (p=0.16 for interaction), for physical strenuousness (p=0.62) nor physical workload (p=0.56). Thus, the analyses were pooled for women and men. Other working condition groups were compared with the lowest risk groups. In model 1, age and gender were adjusted for. In model 2, covariates in model 1 and marital status and employment status were included. In model 3, covariates in model 2 and alcohol use, smoking and BMI were adjusted

for. Model 4 was adjusted for covariates in model 3 and previous antidepressant medication (past 3 months from returning the questionnaire). The proportional hazards assumption was examined using Schoenfeld residuals (Schoenfeld 1982) and confirmed. IBM SPSS 25 statistical package was used.

## 2.6. Sensitivity analyses

Additional sensitivity analyses to confirm our findings with a wider range of working conditions were conducted using a smaller sample ( $n=3907$ ) including only participants that responded to online or mailed surveys. Those who responded to the phone interview were excluded from this analysis since the phone interview did not include all the variables. In addition to the used single-item measures, job demands and job control were measured by the Karasek's job strain questionnaire (Karasek et al. 1998). Job strain was formed by dividing the mean score of the respondent's demands items with the mean score of the respondent's job control items providing a score 0.2-5. Physical working conditions were assessed with an 18-item questionnaire battery developed at the Finnish Institute of Occupational Health (Piirainen et al. 2003). Factor analysis were used to derive three measures which characterise different physical working conditions: 1. physical workload (e.g. heavy physical exertion or lifting and carrying, standing, and walking), 2. hazardous exposure (e.g. exposure to dirt, dampness, noise, irritating substances) and 3. desktop work (e.g. computer use and sedentary work) (Laaksonen et al. 2012). Each measure was classified into three groups according to the lowest and highest quartile cut-points.

## 3. Results

### 3.1. Study population

Table 1 presents the distributions of covariates and working conditions (2017) and the proportion of those with antidepressant medication use during the follow-up year and DDDs (mean and s.e.) for those with medication use. In total, 343 participants (7.6%) had at least one antidepressant medication purchase during the follow-up. Older age groups and women tended to have higher prevalence of medication use than the younger and men did. In addition, those not married/cohabiting had a higher use of antidepressants than the married/cohabiting. In addition, those who were working had a higher use of antidepressants than those temporarily not working. There were no differences according to alcohol use, however, smokers had a higher use of antidepressants than non-smokers did. There was a clear pattern showing increasing antidepressant use with increasing BMI. Among those with previous antidepressant medication use ( $n=210$ ), 86.2% had purchased antidepressants during the follow-up year, whereas of those without previous antidepressant medication use, only 3.8% had purchased antidepressants during the follow-up.

Of those with mentally strenuous work, 12.1% had antidepressant medication use whereas the respective figure in the other groups was less than 7%; however, for those with medication use, DDDs tended to be lower among those with mentally strenuous work than those in non-strenuous work (Table 1). Of those with physically non-strenuous work, 6.9% had subsequent antidepressant medication use whereas among the intermediate and physically strenuous work the corresponding figures were 7.2% and 8.6%, respectively. The mean DDDs were higher among those with physically strenuous work. The patterns were slightly clearer for the other physical work measure showing that those with high volume of physical work had a higher prevalence (10.8%) and somewhat higher DDDs of antidepressant medication use.

### 3.2. Working conditions and risk antidepressant medication use

Working conditions were then examined for the risk of subsequent antidepressant medication use adjusting for covariates. Those with

**Table 1**

Distribution of covariates and working conditions (2017) and antidepressant medication use during one-year follow-up.

	Total n	Medication n (%)	*Mean DDDs (s. e.)
<b>Covariates</b>	4542	347 (7.6)	250.9 (12.0)
<b>Age</b>			
18-29 years	1425	97 (6.8)	240.6 (21.9)
30-34 years	1555	112 (7.2)	242.5 (20.2)
35-39 years	1562	138 (8.8)	265.0 (19.9)
<b>Gender</b>			
Women	3570	286 (8.0)	247.2 (12.8)
Men	972	61 (6.3)	268.3 (31.5)
<b>Marital status</b>			
Married/cohabiting	3069	192 (6.3)	250.0 (16.7)
Not married/cohabiting	1473	155 (10.5)	252.1 (16.9)
<b>Employment status</b>			
Working	4033	323 (8.0)	253.3 (12.5)
Temporarily not working	509	24 (4.7)	220.2 (37.1)
<b>Alcohol use</b>			
Weekly	1245	85 (6.8)	279.8 (29.5)
Occasional or never	3297	262 (7.9)	241.6 (12.6)
<b>Smoking</b>			
Current	1077	125 (11.6)	302.7 (23.2)
Ex-smoker or never	3465	222 (6.4)	221.8 (12.9)
<b>Body mass index</b>			
Obese	634	86 (13.6)	313.5 (28.3)
Overweight	1229	95 (7.7)	273.2 (24.6)
Normal weight	2679	166 (6.2)	205.8 (13.7)
<b>Previous antidepressant medication</b>			
Yes	210	181 (86.2)	324.7 (18.9)
No	4332	166 (3.8)	170.5 (11.1)
<b>Working conditions</b>			
<b>Mental strenuousness</b>			
Non-strenuous	1000	67 (6.7)	283.3 (28.7)
Intermediate	2792	189 (6.8)	251.4 (16.7)
Strenuous	750	91 (12.1)	226.3 (20.4)
<b>Physical strenuousness</b>			
Non-strenuous	939	65 (6.9)	228.3 (25.9)
Intermediate	2007	145 (7.2)	241.6 (17.7)
Strenuous	1596	137 (8.6)	271.6 (20.3)
<b>Physical work volume</b>			
No physical work	1616	119 (7.4)	243.8 (20.5)
Intermediate	2262	156 (6.9)	250.0 (17.4)
High > 4 hrs/day physical work	664	72 (10.8)	264.9 (27.6)

s.e. standard error of the mean

\* mean defined daily doses (DDDs) for those with antidepressant medication use during the follow-up year ( $n=347$ )

mentally strenuous work had an increased risk of antidepressant medication use (HR 1.85, 95%CI 1.35-2.54) compared with those with mentally non-strenuous work when adjusting for age and gender (Table 2). Further adjustments for marital status, employment status as well as health behaviours had only minimal effects on the associations. After adjusting previous antidepressant medication use in the last model, the association somewhat attenuated (HR 1.43, 95%CI 1.03-1.97).

Physical work was associated with antidepressant medication use (Table 2). Those spending more than 4 hours in physical work per day had a higher risk (HR 1.60, 95%CI 1.19-2.15) compared with those reporting no physical work when adjusting for age and gender. Further adjustments for marital status and employment status had no effects but adjusting for health behaviours somewhat attenuated the association (HR 1.43, 95%CI 1.06-1.93). After adjusting for previous antidepressant medication use in the last model, the association remained (HR 1.42, 95%CI 1.05-1.93). Those reporting physically strenuous work had an increased risk of antidepressant medication use (HR 1.30, 95%CI 0.96-1.75) compared with those in physically non-strenuous work when adjusting for age and gender. Further adjustments for marital status and employment status had no effects but adjusting for health behaviours attenuated the association (HR 1.17, 95%CI 0.87-1.59). After adjusting



**Table 2**

Hazard ratios and their 95% confidence intervals for subsequent antidepressant medication use according to working conditions.

	Model 1	Model 2	Model 3	Model 4
<b>Mental strenuousness</b>				
Non-strenuous	1.00	1.00	1.00	1.00
Intermediate	1.00, 0.75-1.32	1.00, 0.76-1.32	0.99, 0.74-1.31	0.95, 0.72-1.26
Strenuous	1.85, 1.35-2.54	1.82, 1.32-2.49	1.77, 1.29-2.43	1.43, 1.03-1.97
<b>Physical strenuousness</b>				
Non-strenuous	1.00	1.00	1.00	1.00
Intermediate	1.06, 0.79-1.42	1.08, 0.81-1.45	1.03, 0.77-1.39	1.17, 0.87-1.57
Strenuous	1.30, 0.96-1.75	1.32, 0.98-1.79	1.17, 0.87-1.59	1.44, 1.06-1.96
<b>Physical work volume</b>				
No physical work	1.00	1.00	1.00	1.00
Intermediate	0.97, 0.76-1.23	0.99, 0.78-1.26	0.94, 0.74-1.20	0.99, 0.77-1.26
High > 4 hrs/day physical work	1.60, 1.19-2.15	1.59, 1.18-2.14	1.43, 1.06-1.93	1.42, 1.05-1.93

Model 1 Age, gender

Model 2 Model 1 + marital status and employment status

Model 3 Model 2 + alcohol use, smoking and BMI

Model 4 Model 3 + previous medication 3 months before survey participation

previous antidepressant medication use in the last model, the association was statistically significant (HR 1.44, 95%CI 1.06-1.96).

### 3.3. Sensitivity analyses

The associations of the above reported single-item variables were practically the same among online and mailed survey responders (Supplements 1-3) as in the full sample. Multi-item measures i.e. Karasek's high job demands showed a similar association to the mental strenuousness of work, whereas low job control showed somewhat weaker and non-significant association after adjusting for covariates. The Karasek's job strain indicating low control and high demands was strongly associated with antidepressant medication use. Of the additional analyses on physical working conditions, physical work was strongly associated with antidepressant medication use. Hazardous exposures and desktop work showed also associations with antidepressant medication use.

We additionally examined correlations between the single-item measures of perceived working conditions with the corresponding multi-item measures of psychosocial and physical working conditions. The Karasek's job demands ( $r=0.45$ ) and strain ( $r=0.32$ ) showed significant correlation with the single-item measure of mental strenuousness of work, whereas, job control ( $r=0.03$ ) had no correlation. The physical strenuousness of work showed significant correlation with the physical work ( $r=0.61$ ) and weaker, but statistically significant correlation with hazardous exposure ( $r=0.16$ ) and desktop work ( $r=-0.27$ ). Similarly, the physical work volume showed significant correlation with the physical work ( $r=0.50$ ) and weaker correlation with hazardous exposure ( $r=0.18$ ) and desktop work ( $r=-0.26$ ).

## 4. Discussion

Studies examining working conditions among younger employees in relation to depression are scarce, and especially physical working conditions have rarely been examined. In this study, we investigated the association between working conditions and subsequent antidepressant medication use among younger municipal employees. Main analyses were conducted using single-item measures of perceived mental and physical strenuousness of work as well as time spent in physical work. The results showed that mentally strenuous work was strongly associated with an increased risk of subsequent antidepressant medication use.

For physical strenuousness, the association was weak but high volume of physical work i.e. more than four hours per workday showed a clear association with antidepressant medication use. Sensitivity analyses with a sub-sample showed practically same associations with the single-item measures, and using wider range of more detailed multi-item measures of both physical and psychosocial working condition confirmed the findings.

### 4.1. Results in relation to previous studies

In general, the results of this study are in line with previous prospective studies among midlife and older employees showing that psychosocial working conditions are associated with the risk of depression, although the magnitude of the associations has varied in some extent in previous studies (Theorell et al. 2015). The review by Theorell et al. (2015) showed that the association with depression is stronger for high job demands and strain than low job control, similar to the present study. Our single-item measure of perceived mental strenuousness of work showed consistent association with antidepressant medication. Furthermore, our previous studies with an older employee cohort have shown that perceived mental strenuousness of work is associated with antidepressant medication use (Laaksonen et al. 2012, Kouvonen et al. 2017). A previous Finnish study (Virtanen et al. 2007) with a representative sample of Finnish employees found that job demands and job strain were associated with subsequent antidepressant medication use among men, however, in women no associations were found, contrary to our study. Yet, in their study job strain was associated with concurrently measured 12-month prevalence of depressive or anxiety disorders in both women and men. However, in general no clear differences between women and men have been observed (Theorell et al. 2015), as corroborated in our present study where no gender interactions were observed.

For physical working conditions, the single-item measure for the volume of physical work indicating high physical workload was associated with subsequent antidepressant medication use. In previous studies, high physical workload has been associated with adverse physical health outcomes such as back pain (Lallukka et al. 2017) and work disability (Ervasti et al. 2019), as well as general health (Bauer et al. 2009). A study by (Halonen et al. 2020) showed that high physical workload increased the risk of disability pension among those with common mental disorders. However, physical workload has been less studied in relation to depression risk (Theorell et al. 2015). In a previous prospective study by Laaksonen et al. (2012) physical workload showed no associations with subsequent antidepressant medication use, when previous medication use was considered. In the present study, adjustment for health behaviours attenuated the associations suggesting that those with physical work have poorer health behaviours and partly due to that a higher risk of antidepressant medication. In contrast, when adjusting for previous antidepressant medication use, the association of the volume of physical work remained, and for the other measure of physical strenuousness of work the association became even stronger and significant. This is likely related to the difference in distribution of the measures capturing different aspects of physical working conditions. It has been suggested that with increasingly sedentary occupations the lack of physical activity may induce mental health problems (Straker and Mathiassen, 2009). Our supplementary analyses in some extent support this as sedentary desktop work was associated with antidepressant medication use, however, further prospective studies applying more detailed measures are needed.

### 4.2. Methodological considerations

The single-item measures of perceived mental and physical strenuousness and volume of physical work provided comparable results to that of more detailed and commonly used multi-item measures of psychosocial (Stansfeld et al. 2012, Kouvonen et al. 2017) and physical working conditions (Pirainen et al. 2003, Laaksonen et al. 2012,

Kouvonen et al. 2017). Of the Karasek's multi-item psychosocial measures, job demands showed the strongest correlation with the mental strenuousness of work. In addition, of the multi-item physical work measures, the physical workload factor had expectedly the strongest correlation with both the physical strenuousness and physical work volume. All measures of working conditions were self-reported, whereas these single-item measures somewhat more directly enquire one's own perception of their work. It should also be noted that the measure of physical strenuousness of work showing statistically non-significant associations might be related to that the two highest groups i.e. rather and very strenuous were pooled for the analyses because a very low number of participants (<4%) were reporting physically very strenuous work. Thus, the strenuous group was very large and likely not able to identify physically strenuous work in a sufficient detail. Furthermore, although we used a register-based measure of antidepressant medication purchases it should be kept in mind that antidepressants are used also for other mental disorders (e.g. anxiety) as well as off-label use such as pain treatment and insomnia, and in the register there was no information of the clinical indication. Thus, the outcome is not purely depression related medication but overall antidepressants are mainly used for alleviating depressive symptoms and other mental health conditions (Wong et al. 2017).

We adjusted for several covariates including age, gender, marital status, employment status, smoking, alcohol use, BMI and previous medication as confounders, however, unmeasured and residual confounding is possible. In addition, we tested for gender interactions and found no statistically significant differences between women and men. Yet, women dominate the results, as three out of four participants were women corresponding with the target population. The results of the study have limited generalisability as male workers were unrepresented and the private sector was not included. We did not adjust for socioeconomic position as working conditions and socioeconomic position are closely related to each other and partly overlapping. Thus, adjusting for socioeconomic position would be an over-adjustment, partly diminishing the own effect of working conditions on mental health. In some extent, the relatively short follow-up period of one year, limits our analyses due a relatively small number of events. Furthermore, although the study design is prospective and previous medication was adjusted, reverse causation is still a possibility as mental health problems and psychotropic medication use may affect how working conditions are perceived.

## 5. Conclusion

The results of this study showed that working conditions contribute to psychotropic medication use already among younger employees. In addition to mentally strenuous work, it is of note that also heavy physical work is linked to subsequent antidepressant medication use. In order to reduce the burden of mental health problems and need for antidepressant medication among all employees, offering better and safer work environment utilising the full potential of work on maintaining good mental health is highly important. Increasing knowledge about work related factors affecting mental health even among younger employees likely drive employers and organisations to improve working conditions. While only a few organisational-level interventions have shown promising in preventing mental health problems (Bourbonnais et al. 2011, Gilbert-Ouimet 2015) further large scale intervention studies with high quality are needed.

## Authors' contributions

Authors JL, TL, JH, HN, MM, OP, OR, AK contributed to designing the study, interpreting results and drafting the manuscript. All authors critically reviewed the manuscript and approved the final version.

## CRedit authorship contribution statement

**Jouni Lahti:** Conceptualization, Methodology, Formal analysis, Visualization, Writing – original draft. **Tea Lallukka:** Conceptualization, Methodology, Writing – review & editing, Funding acquisition. **Jaakko Harkko:** Conceptualization, Methodology, Writing – review & editing. **Hilla Nordquist:** Conceptualization, Writing – review & editing. **Minna Mänty:** Conceptualization, Writing – review & editing. **Olli Pietiläinen:** Conceptualization, Data curation, Writing – review & editing. **Ossi Rahkonen:** Conceptualization, Writing – review & editing, Funding acquisition. **Anne Kouvonen:** Conceptualization, Methodology, Writing – review & editing, Funding acquisition.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Availability of data:** The register data used for the study are not publicly shared due to data protection laws. The data can be applied from the data holders, following data protection laws.

## Acknowledgements

We thank the City of Helsinki and all the members of the Helsinki Health Study group for their contribution.

## Funding

The study was supported by the Academy of Finland (grant 315343) and the Social Insurance Institution of Finland (grants 4/26/2020 and 29/26/2020). AK was supported by the Economic and Social Research Council (ESRC) (grant ES/S00744X/1). OR was supported by the Juho Vainio Foundation.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.psychres.2021.114213](https://doi.org/10.1016/j.psychres.2021.114213).

## References

- Bauer, G.F., Huber, C.A., Jenny, G.J., Muller, F., Hammig, O., 2009. Socioeconomic status, working conditions and self-rated health in Switzerland: explaining the gradient in men and women. *Int. J. Public. Health* 54, 23–30. <https://doi.org/10.1007/s00038-008-7077-2> doi[doi].
- Bonde, J.P., 2008. Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence. *Occup. Environ. Med.* 65, 438–445. <https://doi.org/10.1136/oem.2007.038430> doi[doi].
- Bourbonnais, R., Brisson, C., Vezina, M., 2011. Long-term effects of an intervention on psychosocial work factors among healthcare professionals in a hospital setting. *Occup. Environ. Med.* 68, 479–486. <https://doi.org/10.1136/oem.2010.055202> doi [doi].
- Ervasti, J., Pietiläinen, O., Rahkonen, O., Lahelma, E., Kouvonen, A., Lallukka, T., Mänty, M., 2019. Long-term exposure to heavy physical work, disability pension due to musculoskeletal disorders and all-cause mortality: 20-year follow-up-introducing Helsinki Health Study job exposure matrix. *Int. Arch. Occup. Environ. Health* 92, 337–345. <https://doi.org/10.1007/s00420-018-1393-5> doi[doi].
- GBD 2019 Diseases and Injuries Collaborators, 2020. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 396, 1204–1222. [S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9) [pii].
- Gilbert-Ouimet, M., Baril-Gingras, G., Cantin, V., Leroux, I., Vezina, M., Trudel, L., Bourbonnais, R., Brisson, C., 2015. Changes implemented during a workplace psychosocial intervention and their consistency with intervention priorities. *J. Occup. Environ. Med.* 57, 251–261. <https://doi.org/10.1097/JOM.0000000000000252> doi[doi].

- Halonen, J.I., Manty, M., Pietilainen, O., Kujanpää, T., Kanerva, N., Lahti, J., Lahelma, E., Rahkonen, O., Lallukka, T., 2020. Physical working conditions and subsequent disability retirement due to any cause, mental disorders and musculoskeletal diseases: does the risk vary by common mental disorders? *Soc. Psychiatry Psychiatr. Epidemiol.* 55, 1021–1029. <https://doi.org/10.1007/s00127-019-01823-6> doi[doi].
- Harvey, S.B., Modini, M., Joyce, S., Milligan-Saville, J.S., Tan, L., Mykletun, A., Bryant, R.A., Christensen, H., Mitchell, P.B., 2017. Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occup. Environ. Med.* 74, 301–310. <https://doi.org/10.1136/oemed-2016-104015> doi[doi].
- Henderson, M., Harvey, S.B., Overland, S., Mykletun, A., Hotopf, M., 2011. Work and common psychiatric disorders. *J. R. Soc. Med.* 104, 198–207. <https://doi.org/10.1258/jrsm.2011.100231> doi[doi].
- Jones, P.B., 2013. Adult mental health disorders and their age at onset. *Br. J. Psychiatry Suppl.* 54, s5–10. <https://doi.org/10.1192/bjp.bp.112.119164> doi[doi].
- Karasek, R., Brisson, C., Kawakami, N., Houtman, I., Bongers, P., Amick, B., 1998. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. *J. Occup. Health Psychol.* 3, 322–355. <https://doi.org/10.1037//1076-8998.3.4.322> [doi].
- Kouvonen, A., Manty, M., Lallukka, T., Pietilainen, O., Lahelma, E., Rahkonen, O., 2017. Changes in psychosocial and physical working conditions and psychotropic medication in ageing public sector employees: a record-linkage follow-up study. *BMJ Open* 7, e015573. <https://doi.org/10.1136/bmjopen-2016-015573>, 2016-015573. doi[doi].
- Laaksonen, M., Lallukka, T., Lahelma, E., Partonen, T., 2012. Working conditions and psychotropic medication: a prospective cohort study. *Soc. Psychiatry Psychiatr. Epidemiol.* 47, 663–670. <https://doi.org/10.1007/s00127-011-0372-x> doi[doi].
- Lallukka, T., Pietilainen, O., Jappinen, S., Laaksonen, M., Lahti, J., Rahkonen, O., 2020a. Factors associated with health survey response among young employees: a register-based study using online, mailed and telephone interview data collection methods. *BMC Public Health* 20. <https://doi.org/10.1186/s12889-020-8241-8>, 184-020-8241-8. doi[doi].
- Lallukka, T., Shiri, R., Pietilainen, O., Kausto, J., Sumanen, H., Halonen, J.I., Lahelma, E., Rahkonen, O., Manty, M., Kouvonen, A., 2020b. Timing of Entry into Paid Employment, Adverse Physical Work Exposures and Health: The Young Helsinki Health Study. *Int. J. Environ. Res. Public Health* 17, E7854. <https://doi.org/10.3390/ijerph17217854> [pii].
- Lallukka, T., Viikari-Juntura, E., Viikari, J., Kahonen, M., Lehtimäki, T., Raitakari, O.T., Solovieva, S., 2017. Early work-related physical exposures and low back pain in midlife: the Cardiovascular Risk in Young Finns Study. *Occup. Environ. Med.* 74, 163–168. <https://doi.org/10.1136/oemed-2016-103727> doi[doi].
- Lewer, D., O'Reilly, C., Mojtabai, R., Evans-Lacko, S., 2015. Antidepressant use in 27 European countries: associations with sociodemographic, cultural and economic factors. *Br. J. Psychiatry* 207, 221–226. <https://doi.org/10.1192/bjp.bp.114.156786> doi[doi].
- Piirainen, H., Hirvonen, M., Elo, A., et al., 2003. The Work and Health Interview Study 2003: Basic Report.
- Schoenfeld, D., 1982. Partial residuals for the proportional hazards regression model. *Biometrika* 9, 239–241. <https://doi.org/10.2307/2335876>.
- Siegrist, J., 1996. Adverse health effects of high-effort/low-reward conditions. *J. Occup. Health Psychol.* 1, 27–41. <https://doi.org/10.1037//1076-8998.1.1.27> doi[doi].
- Stansfeld, S.A., Shipley, M.J., Head, J., Fuhrer, R., 2012. Repeated job strain and the risk of depression: longitudinal analyses from the Whitehall II study. *Am. J. Public Health* 102, 2360–2366. <https://doi.org/10.2105/AJPH.2011.300589> doi[doi].
- Straker, L., Mathiassen, S.E., 2009. Increased physical work loads in modern work—a necessity for better health and performance? *Ergonomics* 52, 1215–1225. <https://doi.org/10.1080/00140130903039101> doi[doi].
- Taylor, M., 2017. Good work: the Taylor review of modern working practices. <https://www.gov.uk/government/publications/good-work-the-taylor-review-of-modern-working-practices>.
- Theorell, T., Hammarstrom, A., Aronsson, G., Traskman Bendz, L., Grape, T., Hogstedt, C., Marteinsdottir, I., Skoog, I., Hall, C., 2015. A systematic review including meta-analysis of work environment and depressive symptoms. *BMC Public Health* 15. <https://doi.org/10.1186/s12889-015-1954-4>, 738-015-1954-4. doi[doi].
- Virtanen, M., Honkonen, T., Kivimäki, M., Ahola, K., Vahtera, J., Aromaa, A., Lonnqvist, J., 2007. Work stress, mental health and antidepressant medication findings from the Health 2000. Study. *J. Affect. Disord.* 98, 189–197. S0165-0327(06)00266-7 [pii].
- Whiteford, H.A., Degenhardt, L., Rehm, J., Baxter, A.J., Ferrari, A.J., Erskine, H.E., Charlson, F.J., Norman, R.E., Flaxman, A.D., Johns, N., Burstein, R., Murray, C.J., Vos, T., 2013. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *Lancet* 382, 1575–1586. [https://doi.org/10.1016/S0140-6736\(13\)61611-6](https://doi.org/10.1016/S0140-6736(13)61611-6) doi[doi].
- WHO Collaborating Centre for Drug Statistics Methodology, 2009. Guidelines for ATC classification and DDD assignment, 2010. WHO Collaborating Centre for Drug Statistics, Oslo.
- Wong, J., Motulsky, A., Abrahamowicz, M., Egual, T., Buckeridge, D.L., Tamblyn, R., 2017. Off-label indications for antidepressants in primary care: descriptive study of prescriptions from an indication based electronic prescribing system. *BMJ* 356, j603. <https://doi.org/10.1136/bmj.j603> doi[doi].
- Woo, J.M., Postolache, T.T., 2008. The impact of work environment on mood disorders and suicide: Evidence and implications. *Int. J. Disabil. Hum. Dev.* 7, 185–200. <https://doi.org/10.1515/ijdh.2008.7.2.185> doi[doi].